ORIGINAL ARTICLE

# Educational intervention to improve menstrual health knowledge among adolescent schoolgirls at a private school in Peru: a pre-experimental study

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**ABSTRACT**

**Objective**: To evaluate the effectiveness of an educational intervention in improving menstrual health knowledge among adolescent schoolgirls at a school in the district of San Juan de Lurigancho, Lima, Peru.
**Methods**: A pre-experimental one-group pretest–posttest study was conducted with 20 female students. An author-developed questionnaire (KR-20 = 0.72; Aiken's V = 1.00) was administered before and after a five-session weekly educational intervention based on meaningful learning. Knowledge of physiological aspects, hygiene and self-care, and myths and beliefs related to menstruation was assessed. The Wilcoxon test was used ($p < 0.05$), and the effect size was estimated using Cohen's d.
**Results**: The median age was 15 years (IQR: 14–15). A significant increase in the total knowledge score was observed after the intervention (22 at pretest and 29 at posttest; $p < 0.001$), with a large effect size (d = 1.40; 95% CI: 0.77–2.02). The greatest improvements were observed in items related to the phases of the menstrual cycle (from 35.0% at pretest to 95.0% at posttest), the direction of genital cleansing (from 35.0% at pretest to 95.0% at posttest), and in the identification of myths, such as the perception of menstruation as contaminated blood (from 45.0% at pretest to 95.0% at posttest).
**Conclusion**: The educational intervention was associated with a significant improvement in menstrual health knowledge among adolescent schoolgirls, with a large effect size. These findings support the implementation of structured educational programs in school settings, although studies with more robust designs are needed to confirm the effectiveness and sustainability of such interventions.

**Keywords**: Adolescent; Efficacy; Students; Education; Menstruation (Source: MeSH)

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# Intervención educativa para mejorar los conocimientos sobre salud menstrual en escolares adolescentes de una institución educativa privada peruana: estudio preexperimental

**RESUMEN**

**Objetivo**: Evaluar la eficacia de una intervención educativa para mejorar los conocimientos sobre salud menstrual en adolescentes escolares de una institución educativa del distrito de San Juan de Lurigancho, Lima, Perú.
**Métodos**: Estudio preexperimental con diseño pretest–postest en 20 escolares de sexo femenino. Se aplicó un cuestionario de elaboración propia (KR-20 = 0,72; V de Aiken = 1,00) antes y después de una intervención educativa de cinco sesiones semanales, basada en el aprendizaje significativo. Se evaluaron los conocimientos sobre aspectos fisiológicos, higiene y autocuidado, así como mitos y creencias. Se utilizó la prueba de Wilcoxon ($p < 0,05$) y se estimó el tamaño del efecto con la d de Cohen.
**Resultados**: La mediana de edad fue de 15 años (RIC: 14–15). Se observó un incremento significativo en el puntaje total de conocimientos tras la intervención (22 en el pretest y 29 en el postest; $p < 0,001$), con un tamaño de efecto grande (d = 1,40; IC 95 %: 0,77–2,02). Las mayores mejoras se evidenciaron en los ítems relacionados con las fases del ciclo menstrual (de 35,0 % en el pretest a 95,0 % en el postest), la dirección de la higiene genital (de 35,0 % en el pretest a 95,0 % en el postest) y la identificación de mitos,

como la percepción de la menstruación como sangre contaminada (de 45,0 % en el pretest a 95,0 % en el postest).
**Conclusión**: La intervención educativa se asoció con una mejora significativa de los conocimientos sobre salud menstrual en escolares adolescentes, con una magnitud de efecto grande. Estos hallazgos respaldan la implementación de programas educativos estructurados en el ámbito escolar, aunque se requieren estudios con diseños más robustos para confirmar su eficacia y sostenibilidad.

**Palabras clave**: Adolescentes; Eficacia; Estudiantes; Intervención Educativa; Menstruación (Fuente: DeCS)

# INTRODUCTION

Adolescence, defined as the period between 12 and 17 years of age, is characterized by biological, cognitive, and behavioral changes (1,2). Menarche is among the biological changes that occur during this stage, making adequate menstrual health essential. Menstrual health is understood as having access to the materials, health services, and basic conditions, such as water and sanitation, required for appropriate menstrual management (3). However, factors such as poverty, stigma, and myths continue to limit the possibility of such adequate management (4).

Current evidence shows that a substantial proportion of adolescents lack sufficient knowledge of menstrual hygiene. A previous study among adolescent schoolgirls in India found that 37% did not achieve acceptable knowledge scores on this topic (5). This lack of menstrual health information may contribute to school absenteeism, as reported in another study from the same country, in which 40.0% of students were absent from school during menstruation (6). In Peru, it has been reported that 80% of adolescents do not have a good level of knowledge of menstrual hygiene and that 60% have a low level of knowledge (7,8). Additionally, 30 of 112 students had missed school at least once because of menstruation, and 63 had heard jokes or teasing related to menstruation (9).

In this context, access to accurate menstrual health information is a key determinant that can transform the experience of the menstrual cycle from a passive or stigmatized perspective into an informed and proactive approach, thereby reducing psychological and social barriers (10). Although several educational interventions have been shown to improve knowledge and practices, evidence regarding their impact on psychosocial and educational well-being remains limited, particularly in low-resource settings (11). In this scenario, inadequate information exposes adolescents to stigma, exclusion, and difficulties in their daily lives, including school attendance (12).

Internationally, educational interventions with favorable outcomes in menstrual hygiene knowledge and practices among adolescents have been reported in both Africa and Asia, showing substantial improvements after implementation (13–15). Nevertheless, the need to generate context-specific evidence persists.

In Peru, although Law No. 31148 was enacted to guarantee access to information, products, and services related to menstrual management, its implementation remains limited because implementing regulations establishing the mechanisms for its application have not yet been issued. Consequently, gaps persist in effective access to the resources and information required for appropriate menstrual health management (16). This situation is particularly relevant in vulnerable urban settings such as the district of San Juan de Lurigancho, which is characterized by unfavorable socioeconomic conditions and limited access to education and basic services (17).

In this context, the World Health Organization (18) recognizes menstruation as a public health and human rights issue and highlights the importance of access to education and information for girls and adolescents. Although international evidence supports the effectiveness of educational interventions in improving menstrual health knowledge, this evidence comes from countries in Asia and Africa. In Peru, evidence is scarce and is derived mainly from theses; moreover, several of these educational interventions have been delivered in a single session, particularly in public schools located in vulnerable urban settings. This limitation hinders the development of educational strategies supported by reliable local evidence and adapted to the national context. Therefore, this study aimed to evaluate the effectiveness of an educational intervention in improving menstrual health knowledge among students at a school in the district of San Juan de Lurigancho, Lima, Peru.

# METHODS

### Study design

A pre-experimental study with pretest and posttest measurements in a single intervention group, without a control group, was conducted.

### Population and sample

The population comprised 21 female students enrolled in the third year of secondary school at a private educational institution in the district of San Juan de Lurigancho, Lima, Peru, during 2024. Participants whose parents or legal guardians signed the informed consent form were included, whereas those who did not provide informed assent or were absent from any session were excluded. Thus, the final sample included 20 students who completed the entire intervention and answered both the pretest and posttest. Because of the small population size, census sampling was performed, and no sample size calculation was conducted.

The educational institution provides coeducational regular basic education for male and female students; however, this study focused exclusively on female students because of the nature of the content assessed. Furthermore, according to the institutional curriculum, no systematic implementation of comprehensive sexuality education content was identified at the grade level attended by the study group.

### Technique and instrument

An author-developed questionnaire was administered before and after the intervention. The following sources were used to develop the questionnaire: Manual sobre salud e higiene

menstrual para facilitadoras y facilitadores, published by UNICEF Mexico in 2020; Guía de Salud Menstrual, published by Escuela La Tribu in 2022; and Manual sobre salud menstrual para facilitadoras y facilitadores, published by UNICEF Mexico in 2024 (19–21).

The questionnaire was structured into three sections: the first comprised nine items assessing knowledge of the physiological aspects of menstruation; the second comprised 15 items on hygiene and self-care during menstruation; and the third comprised six items on myths and beliefs related to menstruation. All questionnaire items were multiple-choice and had only one correct answer. Each correct answer was assigned one point, whereas incorrect or unanswered questions were assigned zero points.

The content validity of the questionnaire was assessed through expert judgment by three obstetric professionals with expertise in teaching and reproductive health, identified by the initials GFME, BALM, and GGPS. They had 20, 15, and 30 years of experience, respectively, as well as specialized training in sexual health and teaching. The assessment considered the clarity, sufficiency, relevance, and coherence of the items, and yielded an Aiken's V coefficient of 1.00. Subsequently, a pilot test was conducted among 10 adolescents with characteristics similar to those of the target population, selected by convenience sampling, to assess comprehension of the items and estimate the internal consistency of the instrument. Reliability was determined using the Kuder–Richardson 20 coefficient (KR-20), which yielded a value of 0.72. The pilot test revealed no comprehension difficulties; therefore, no modifications to the instrument were required.

**Variables**

The primary outcome (dependent) variable was the level of menstrual health knowledge, measured using the items of the previously described instrument. These items provided information on learning related to the topics addressed in each intervention session. This variable comprised three dimensions: knowledge of the physiological aspects of menstruation, knowledge of appropriate hygiene and self-care practices during menstruation, and knowledge of myths and beliefs related to menstruation.

The variables used to characterize the sample were the adolescent's age, the father's and mother's educational attainment, the adolescent's religion, and age at menarche.

**Intervention**

The educational intervention consisted of five weekly in-person sessions, each lasting approximately 90 minutes and comprising theoretical and practical components. The intervention was designed and delivered by obstetric professionals with experience in sexual and reproductive health, and its content was previously developed and reviewed by the authors.

A cognitivist approach based on meaningful learning was used (22), with pedagogical strategies aimed at activating prior knowledge, progressively constructing knowledge, and applying the content in practice. Each session followed a standardized structure that included: (1) a motivational activity, (2) exploration of prior knowledge, (3) presentation and development of the thematic content, and (4) metacognitive activities aimed at consolidating learning.

The content was organized into five sequential modules delivered weekly: (1) adolescence and its emotional changes; (2) menstruation and the menstrual cycle; (3) menstrual well-being and myths about menstruation; (4) menstrual products; and (5) good hygiene practices (Supplementary Material).

The intervention was implemented between September and October 2024 under standardized classroom conditions and with supervised attendance to ensure that all participants received the complete scheduled content. Audiovisual resources, graphic materials, anatomical models, and menstrual products, such as sanitary pads, tampons, and menstrual cups, were used, together with participatory and demonstrative activities aimed at reinforcing comprehension and application of the content. All participants received the intervention under the same time and location conditions. Full details of the sessions are provided in the Supplementary Material.

**Procedures**

After the corresponding institutional approvals were obtained, informed consent was requested from the parents or guardians of the students, and informed assent was obtained from each participant during an in-person classroom visit. Subsequently, the dates for the five learning sessions comprising the educational intervention were coordinated, and the sessions were conducted weekly during tutoring periods. Before the first session began, the study questionnaire was administered to each student as the baseline measurement (pretest). The five scheduled educational sessions were then conducted, and one week later, the questionnaire was administered again as the post-intervention measurement (posttest), primarily to assess immediate knowledge acquisition and, secondarily, short-term retention of learning. A total of five weeks elapsed between the baseline measurement and the final assessment.

**Data analysis**

Data collected using the study instrument were entered into a database in Microsoft Office Excel 2013 (Microsoft Corporation, Redmond, WA, USA). Statistical analyses were performed using Stata version 17 (StataCorp LLC, College Station, TX, USA) and RStudio 4.2.1 (Posit Software, Boston, MA, USA).

The variables used to characterize the sample were summarized using descriptive statistics. Examination of the distribution of the differences between pretest and posttest scores using the Shapiro–Wilk normality test showed that the data were not normally distributed ($p < 0.001$). Therefore, the Wilcoxon test was used to compare the total pretest and posttest scores. A p-value $< 0.05$ was considered statistically significant. The effect size was also estimated using Cohen's d for paired samples (dz), together with its 95% confidence interval (95% CI). Cohen's d was calculated as the mean of the differences between posttest and pretest scores divided by the standard deviation of those differences. This measure was selected because the study used a pretest–posttest design with repeated measurements in the same participants, allowing quantification of the magnitude of the change produced by the intervention and facilitating interpretation of the findings.

An inferential comparison of correct and incorrect responses for each item between the pretest and posttest was considered; however, this analysis was not performed because of the ceiling effect observed for several items (2, 3, 8, 10, 14, 22, 25, 27, and 29) during the posttest and the small sample size. Therefore, changes in correct responses by item were presented descriptively using absolute and relative frequencies.

### Ethical considerations

The study was approved by the Research Ethics Committee of the Facultad de Medicina de San Fernando (No. 271-2024) and was authorized by the authorities of the educational institution where the intervention was conducted. Informed consent was also obtained from the parents or legal guardians, and informed assent was obtained from the participating students before their inclusion in the study. Confidentiality was maintained by safeguarding and anonymizing each participant's personal data. Participants were informed that participation in the study was entirely voluntary and that declining to participate would have no academic, personal, or other consequences.

## RESULTS

### Sample characteristics

After one student was excluded from the analysis because she did not attend the first session, the final sample comprised 20 adolescent schoolgirls with a median age of 15 years (interquartile range [IQR]: 14–15). The median age at menarche was 11 years (IQR: 10–12). Regarding religious affiliation, Catholicism predominated (70.0%), followed by other beliefs in smaller proportions. With respect to parental educational attainment, most participants reported higher education for both their fathers (60.0%) and mothers (55.0%) (Table 1).

**Table 1**. Characteristics of the students who participated in the intervention and their parents (n = 20)

| Characteristics | n (%) |
|---|---|
| Age | |
| Median (IQR) | 15 (14–15) |
| Age at menarche | |
| Median (IQR) | 11 (10–12) |
| Religion | |
| Catholic | 14 (70.0) |
| Evangelical | 2 (10.0) |
| Jehovah's Witness | 1 (5.0) |
| Atheist | 3 (15.0) |
| Father's educational attainment | |
| Primary education | 3 (15.0) |
| Secondary education | 5 (25.0) |
| Higher education | 12 (60.0) |
| Mother's educational attainment | |
| Primary education | 4 (20.0) |
| Secondary education | 5 (25.0) |
| Higher education | 11 (55.0) |

IQR: interquartile range.

### Physiological aspects dimension

An increase in the proportion of correct responses was observed for most items after the educational intervention. The greatest improvements were found in items related to the phases of the menstrual cycle, which increased from 35.0% at pretest to 95.0% at posttest, as well as in those related to ovulation (from 65.0% at pretest to 90.0% at posttest) and nutrition during menstruation (from 60.0% at pretest to 90.0% at posttest). In contrast, some items had high percentages of correct responses at pretest, such as recognition of the first menstruation and the duration of the cycle, reaching values close to 100% at posttest (Table 2).

### Hygiene and self-care dimension

The greatest improvements were observed in knowledge of the correct direction for cleansing the external genitalia (from 35.0% at pretest to 95.0% at posttest), the appropriate frequency of sanitary pad changes (from 35.0% at pretest to 85.0% at posttest), and the use of appropriate items for genital hygiene (from 25.0% at pretest to 75.0% at posttest). Increases were also observed in the recognition of basic menstrual hygiene measures (from 55.0% at pretest to 80.0% at posttest), the importance of tracking the menstrual period (from 65.0% at pretest to 85.0% at posttest), and the possibility of bathing during menstruation (from 65.0% at pretest to 90.0% at posttest). In contrast, items related to handwashing, seeking care for abnormal symptoms, and the disposal of sanitary pads had correct response rates of at least 95.0% at pretest and remained high at posttest (Table 3).

### Myths and beliefs about menstruation dimension

An increase in the proportion of correct responses was observed, particularly in the identification of misconceptions. The largest changes were found in items related to the perception of menstruation as contaminated blood (from 45.0% at pretest to 95.0% at posttest) and the recommendation to avoid bathing during the menstrual period (from 40.0% at pretest to 90.0% at posttest). In addition, 100% correct response rates were achieved for the recognition of appropriate practices, such as washing the genital area and changing underwear during menstruation (Table 4).

### Total scores before and after the intervention

A significant increase in the total knowledge score was observed after the educational intervention using the Wilcoxon test ($p < 0.001$). The median score increased from 22 at pretest to 29 at posttest, reflecting an overall improvement in the participants' level of knowledge. The effect size was also large (Cohen's $d = 1.40$; 95% CI: 0.77–2.02) (Figure 1).

**Table 2**. Correct responses to items in the "Physiological aspects" dimension before and after the intervention

| Questionnaire items | Correct responses at pretest, n | % | Correct responses at posttest, n | % |
|---|---|---|---|---|
| 1. What is menstruation? | 15 | 75.0 | 19 | 95.0 |
| 2. What is the average duration of menstruation? | 18 | 90.0 | 20 | 100.0 |
| 3. What is the first menstrual period called? | 19 | 95.0 | 20 | 100.0 |
| 4. What is premenstrual syndrome? | 15 | 75.0 | 17 | 85.0 |
| 5. What are the phases of the menstrual cycle? | 7 | 35.0 | 19 | 95.0 |
| 6. What is ovulation? | 13 | 65.0 | 18 | 90.0 |
| 7. During which phase of the menstrual cycle is the risk of pregnancy highest? | 15 | 75.0 | 18 | 90.0 |
| 8. Which hormones primarily regulate the menstrual cycle? | 18 | 90.0 | 20 | 100.0 |
| 9. What types of foods help compensate for blood loss during menstruation? | 12 | 60.0 | 18 | 90.0 |

**Table 3**. Correct responses to items in the "Hygiene and self-care" dimension before and after the intervention

| Questionnaire items | Correct responses at pretest, n | % | Correct responses at posttest, n | % |
|---|---|---|---|---|
| 10. What should you use to wash your hands before and after using menstrual products? | 19 | 95.0 | 20 | 100.0 |
| 11. What can happen if I change my disposable sanitary pad once a day? | 19 | 95.0 | 18 | 90.0 |
| 12. In which direction should the external genitalia be cleaned after urination or defecation? | 7 | 35.0 | 19 | 95.0 |
| 13. What is the basic measure for maintaining proper menstrual hygiene? | 11 | 55.0 | 16 | 80.0 |
| 14. Whom should you consult if you experience any abnormal menstrual symptoms? | 20 | 100.0 | 20 | 100.0 |
| 15. Who decides which menstrual product to use? | 7 | 35.0 | 13 | 65.0 |
| 16. Is it important to track the menstrual period? | 13 | 65.0 | 17 | 85.0 |
| 17. Can a menstruating woman bathe normally during her period? | 13 | 65.0 | 18 | 90.0 |
| 18. How often is it recommended to change a disposable sanitary pad? | 7 | 35.0 | 17 | 85.0 |
| 19. Should a disposable sanitary pad be changed only when it is completely soiled? | 16 | 80.0 | 17 | 85.0 |
| 20. What is the first step before using any menstrual product? | 14 | 70.0 | 18 | 90.0 |
| 21. Where is the disposable sanitary pad placed? | 20 | 100.0 | 19 | 95.0 |
| 22. Where should disposable sanitary pads be discarded? | 20 | 100.0 | 20 | 100.0 |
| 23. How should disposable sanitary pads be discarded? | 20 | 100.0 | 19 | 95.0 |
| 24. What is the only item needed to wash the external genitalia during menstruation? | 5 | 25.0 | 15 | 75.0 |

# DISCUSSION

This study showed a significant increase in menstrual health knowledge among adolescent schoolgirls after a structured five-session educational intervention, both overall and across specific dimensions. Beyond statistical significance, the observed effect size (d = 1.40; 95% CI: 0.77–2.02) suggests that the intervention was associated with a change of practical importance.

This finding is consistent with the accumulated evidence supporting the effectiveness of menstrual health education interventions. Accordingly, the effect size observed in this study was large, exceeding the conventional threshold of 0.8 used to interpret Cohen's d. In the systematic review by Evans et al. (23), although all included studies showed improvements in knowledge, effect sizes were heterogeneous and depended largely on the pedagogical approach, with larger values reported for participatory interventions. In this regard, the cognitivist approach adopted in the present study, based on meaningful learning, activation of prior knowledge, and active participation, may have contributed to the magnitude of the observed change.

**Table 4**. Correct responses to items in the "Myths and beliefs about menstruation" dimension before and after the intervention

| Questionnaire items | Correct responses at pretest, n | % | Correct responses at posttest, n | % |
|---|---|---|---|---|
| 25. Is washing the external genitalia during menstruation recommended? | 16 | 80.0 | 20 | 100.0 |
| 26. Is bathing during menstruation recommended? | 8 | 40.0 | 18 | 90.0 |
| 27. Is changing underwear during menstruation recommended? | 18 | 90.0 | 20 | 100.0 |
| 28. Is menstruation a disease? | 19 | 95.0 | 20 | 100.0 |
| 29. Does a girl menstruate because she has already become sexually active? | 20 | 100.0 | 20 | 100.0 |
| 30. Is menstruation contaminated blood? | 9 | 45.0 | 19 | 95.0 |

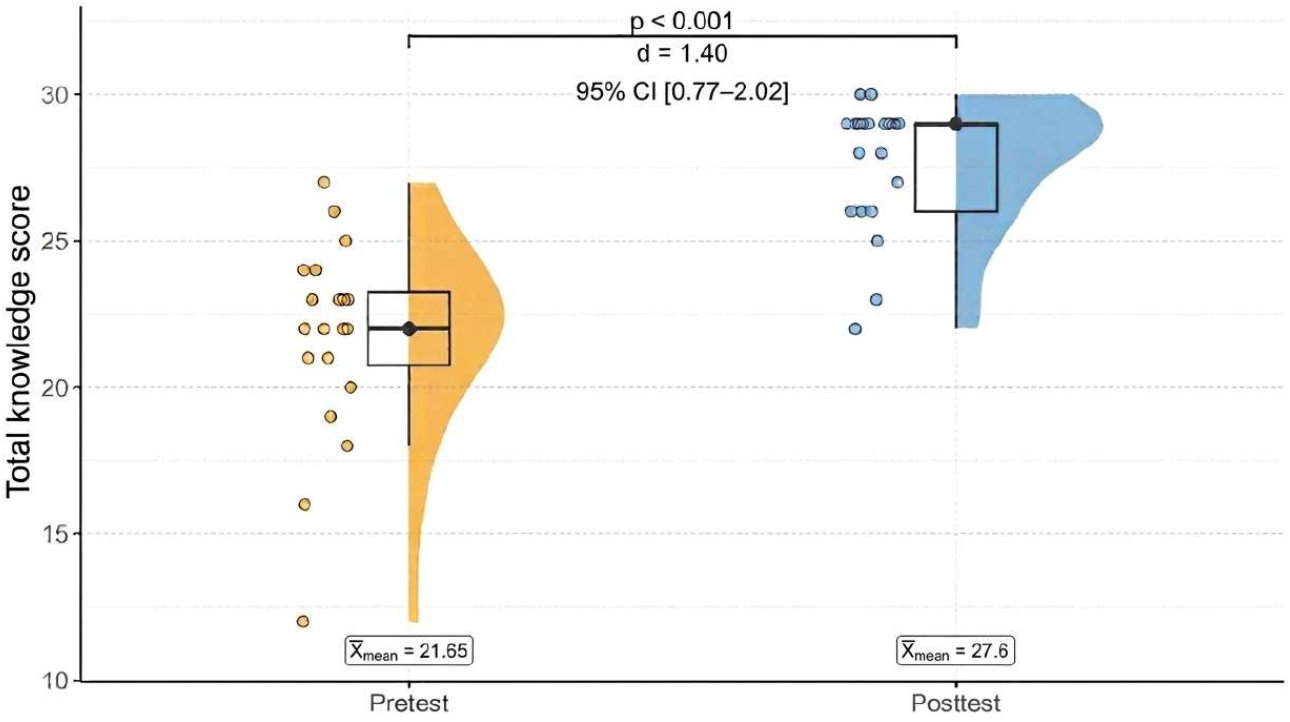


**Figure 1**. Raincloud plots comparing the total scores on the menstrual health knowledge questionnaire before and after the educational intervention

d: Cohen's d; 95% CI: 95% confidence interval. Pretest median = 22; posttest median = 29.

The results are also consistent with experimental and quasi-experimental studies that have documented significant improvements in knowledge following educational interventions. Darabi and Yaseri (24) reported significant increases in knowledge and behavioral constructs after multiple educational sessions, whereas Ghimire et al. (25) found marked improvements in both knowledge and practices. Similarly, Nastiti et al. (26) observed that changes were significant only in the group exposed to a structured intervention, reinforcing the relevance of an active educational component compared with passive strategies.

An important contribution of this study is the identification of differentiated improvements across dimensions. Regarding physiological aspects, the largest increases were concentrated in content of greater conceptual complexity, such as the phases of the menstrual cycle and ovulation, suggesting that the intervention addressed specific knowledge gaps rather than merely reinforcing previously acquired knowledge. This pattern is consistent with the findings of Fuadah et al. (27), who reported that

educational interventions tend to produce greater changes in areas related to conceptual understanding and the correction of misinformation.

In the hygiene and self-care dimension, the observed increases in knowledge of specific practices, such as the frequency of sanitary pad changes and the appropriate cleansing technique, are consistent with evidence linking education to potential improvements in behavior. Studies such as that by Haque et al. (28) have documented substantial changes in practices following prolonged educational interventions, whereas Ayieko et al. (29) showed that these improvements may extend to dimensions such as self-efficacy, school participation, and reduced anxiety. However, it is important to note that observed practices were not assessed in the present study; therefore, inferences regarding behavioral changes should be made cautiously.

Regarding myths and beliefs, the observed improvements in the identification of misconceptions reflect the intervention's ability to address sociocultural determinants of behavior. This finding is particularly relevant because persistent misconceptions have been widely documented as a barrier to adequate menstrual health. Chaliawala and Dubey (30) emphasized that stigma and misinformation continue to shape restrictive practices, whereas Bollinger et al. (31) showed that educational interventions can modify perceptions and attitudes, even in settings where such beliefs are deeply rooted.

Additionally, the results of this study are consistent with interventions that integrate multiple educational components. Revankar et al. (32) reported significant improvements in knowledge and practices through interventions combining education, teaching materials, and behavioral strategies. Complementarily, the review by Joshi and Mendhe (33) highlighted that structured school-based programs are particularly effective when they incorporate participatory and context-specific approaches, which is consistent with the structure of the intervention implemented in this study.

Nevertheless, the magnitude of the observed effect should be interpreted in light of the study design. Because this was a pre-experimental study without a control group, the influence of factors such as repeated-measurement effects, familiarity with the instrument, or exposure to external information during the intervention period cannot be ruled out. This limitation is consistent with the findings of Pratama et al. (34), who noted that much of the evidence in this field comes from designs with limited control, which may affect effect estimates.

Likewise, the use of an author-developed instrument, although it demonstrated adequate content validity and internal consistency, may have increased sensitivity to change and limited comparability across studies. This issue is relevant because the literature reports considerable heterogeneity in the instruments used to measure menstrual health knowledge, making it difficult to synthesize results and compare effect sizes.

The small sample size and inclusion of a single educational institution may have limited the statistical power to detect smaller differences and, thus, restrict the generalizability of the findings to other populations. In contrast, studies with larger samples and longitudinal follow-up, such as that by Ayieko et al. (29), allow assessment of the sustainability of effects and their impact on broader outcomes, representing an important direction for future research.

Finally, although a significant improvement in knowledge was observed, the literature suggests that such changes do not necessarily translate into sustained changes in practices, particularly in settings where structural barriers persist. Furthermore, although the pre-experimental design without a control group limits causal attribution of the observed effects, the educational setting in which the intervention was conducted suggests a low likelihood of concurrent exposure to structured menstrual education content, given that no systematic implementation of comprehensive sexuality education was identified at the assessed grade level according to the institutional curriculum. This reduces the plausibility that the observed changes resulted from external interventions; however, the influence of factors such as testing effects, maturation, formal or informal exposure to menstrual health information, or the Hawthorne effect cannot be completely ruled out, because participants knew that they were part of an educational intervention and were assessed before and after its implementation, which may have temporarily increased their motivation or attention during the assessment.

In this regard, future research should incorporate longitudinal measurements, assessment of observed practices, and, where possible, experimental designs with a control group to enable more precise estimation of intervention effects. In addition, because the posttest was administered one week after the intervention, medium- and long-term retention of information could not be confirmed. Therefore, future studies should include additional assessments three to six months after the intervention.

In conclusion, the educational intervention was associated with improved knowledge of menstrual health among adolescents at this private educational institution, with a large effect size and consistent improvements across multiple dimensions. These findings reinforce the importance of implementing structured and participatory educational interventions in school settings. However, interpretation of the results should consider the limitations of the study design; therefore, the evidence should be strengthened through studies with greater methodological rigor and long-term outcome assessment.

**Author contributions**

GCMM: Conceptualization, Investigation, Formal analysis, Writing – original draft, Writing – review and editing. BECH: Conceptualization, Writing – original draft, Writing – review and editing. All authors approved the final version of the manuscript.

**Conflicts of interest**

The authors declare no relevant financial or non-financial conflicts of interest.

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**Data availability**

The data supporting the findings of this study are available upon request from the corresponding author.

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